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1.0 Objective

This specification defines the performance, test, quality and reliability requirements of the EyeMax™ I/O connectors.


2.0 Scope

This specification is applicable to the contact interface of the EyeMax™ Receptacle and Plug assembly.

3.0 General

This document is composed of the following sections:

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4.0 Applicable Documents

4.1 Product Drawings

4.1.1 Engineering drawings

4.2 Other Standards and Specifications

- 4.2.1 UL94-VO: Flammability
- 4.2.2 EIA 364: Electrical Connector/Socket Test Procedures Including Environmental Classifications.
- 4.2.3 ISO 9000: Quality System Requirements
- 4.2.4 ANSI Z-540: Calibration Laboratories Equipment General Requirements
- 4.2.5 InfiniBand™ Trade Association (IBTA) Architecture Specification
- 4.2.6 SFF-8470: Specification For Multi Lane Copper Connector

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4.3 FCI Specifications

- 4.3.1 BUS-02-055: Plastic Resin Selection
- 4.3.2 BUS-02-056: Metal Selection
- 4.3.3 BUS-02-057: Plating Selection Guidelines
- 4.3.4 BUS-19-002/A: Solderability of Plated Material or Contacts
- 4.3.5 GS-12-216: EyeMax™ Cable Assembly Product Specification

5.0 Requirements

5.1 Qualification

Connectors furnished under this specification shall be capable of meeting the qualification test requirements specified herein.

5.2 Material


The material for each component shall be as specified herein or equivalent. Reference BUS-02-055 and BUS-02-056.

5.2.1 Board Receptacle

- 5.2.1.1 Contact: Copper Alloy
- 5.2.1.2 D-Shell: Cold Rolled Steel
- 5.2.1.3 Housing: High Temperature Thermoplastic UL94 V-0
- 5.2.1.4 Latch Plate: Cold Rolled Steel
- 5.2.1.5 EMI Gasket: Copper Alloy
- 5.2.1.6 Lock Plate: Stainless Steel
- 5.2.1.7 Screw: Stainless Steel
- 5.2.1.8 Threaded Insert: Brass
- 5.2.1.9 EMI Gasket (Thumbscrew): Conductive Foam
- 5.2.1.10 Threaded Stand-off (Thumbscrew): Stainless Steel
- 5.2.1.11 Thumbscrew: Stainless Steel

5.2.2 Cable Plug

- 5.2.2.1 Contact: Copper Alloy
- 5.2.2.2 Backshell: Die Cast
- 5.2.2.3 Housing: High Temperature Thermoplastic UL94 V-0
- 5.2.2.4 Latch: Stainless Steel
- 5.2.2.5 Pull Tab: Thermoplastic
- 5.2.2.6 Cable Collar: Thermoplastic
- 5.2.2.7 Screw: Stainless Steel

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5.3 Finish

The finish for applicable components shall be as specified herein or equivalent. Reference BUS-02-057.

5.3.1 Board Receptacle

- 5.3.1.1 Contact: Gold in contact area; Tin/Lead in solder tail area over Nickel underplate.
- 5.3.1.2 Shell: Nickel.
- 5.3.1.3 Latch Plate: Tin-lead over Nickel.
- 5.3.1.4 EMI Gasket: Nickel.
- 5.3.1.5 Receptacle Lock Plate: No finish.
- 5.3.1.6 Screw: No finish.
- 5.3.1.7 Threaded Insert: Nickel.

5.3.2 Cable Plug

- 5.3.2.1 Contact: Gold in contact area; Tin/lead in solder tail area over Nickel underplate.
- 5.3.2.2 Shell: Nickel over Copper.
- 5.3.2.3 Latch: No finish.
- 5.3.2.4 Screw: No finish.

5.4 Designs And Construction

Connectors shall be of the design, construction, and physical dimensions specified on the applicable product drawings.


6.0 Electrical Characteristics

6.1 **Contact Resistance, Low Level (LLCR)** - The low level contact resistance shall not exceed 70 mΩ when measured in accordance with EIA 364-23. Resistance change after any environmental exposure shall not exceed 20 mΩ. The following details shall apply:

- a. Test Voltage - 20 mV DC max open circuit.
- b. Test Current - Not to exceed 10 mA.

6.2 **Insulation Resistance** - The insulation resistance of mated connectors shall not be less than 1000 megohms when measured in accordance with EIA 364-21. The following details shall apply:

- a. Test Voltage - 300 volts DC.
- b. Electrification Time - 1 minute.
- c. Points of Measurement - Between adjacent contacts, between contacts and grounds and between contacts and shell.

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6.3 **Dielectric Withstanding Voltage (DWV)** - There shall be no evidence of arc-over, insulation breakdown, or excessive leakage current (> 1 mA) when mated connectors are tested in accordance with EIA 364-20. The following details shall apply:

- a. Test Voltage - 300 volts DC.
- b. Test Duration - 60 seconds.
- c. Test Condition - 1 (760 Torr - sea level).
- d. Points of Measurement - Between adjacent contacts, between contacts and grounds and between contacts and shell.

6.4 **Current Rating** - The temperature rise above ambient shall not exceed 30 degrees C at any point in the system when all signal contacts are powered at 0.5 amperes when evaluated according to EIA 364-70. The following details shall apply:

- a. Ambient Conditions - Still air at 25 degrees C.
- b. Reference – FCI Specification BUS-03-601 Current Rating.

6.5 **Differential Impedance (peak)** – The average value measured over the propagation delay of the mated connector shall not be less than 90 Ω and shall not exceed 110 Ω . The following details shall apply:

- a. Rise time - 100 picoseconds (20%-80%).
- b. Points of measurement - Includes connector, cable to connector interface, and board-to-board termination pads and vias but not equalizer.
- c. Reference – EIA 364-108.

6.6 **Insertion Loss** - The insertion loss of mated connectors shall not exceed 1.0 dB. The following details shall apply:

- a. Frequency - 1.25 GHz.
- b. Reference - EIA 364-101.

6.7 **Near End Crosstalk** - The specification requirement shall be satisfied when evaluated in accordance with EIA 364-90 and the following details:


- a. Specification requirement – Sum of 4 pairs: Less than 4%.
- b. Rise time – 100 picoseconds.
- c. Sample test conditions – Input signal to 1 pair and measure the effects in adjacent 2 pairs.
- d. Reference FCI Specification BUS-03-108 Crosstalk Methods.

6.8 **Within Pair Skew** – The specification requirement shall be less than 5 picoseconds when evaluated in accordance with EIA 364-103.

6.9 **Jitter** – See GS-12-216, EyeMax™ Cable Assembly Specification

6.10 **Return Loss** – See GS-12-216, EyeMax™ Cable Assembly Specification

6.11 **Eye Patterns** – See GS-12-216, EyeMax™ Cable Assembly Specification

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7.0 Mechanical Characteristics

7.1 Mating/Unmating Force - The force to mate a receptacle connector and compatible plug connector shall not exceed values specified in Table 1. The unmating force shall be no less than the values specified in Table 1 with the plug latches disengaged or removed. The following details shall apply:

- Cross Head Speed – 25.4 mm/min, utilize free-floating fixtures.
- Reference - EIA 364-13.

			Units
Mating Force	4X	30 Maximum	N
	12X	60 Maximum	N
Unmating Force	4X	15 Minimum	N
	12X	20 Minimum	N


Table 1

7.2 Retention Force – The connector components shall not exhibit any detrimental effects when the attached cable is subjected to an axial tensile load of not less than 75 N. The following details shall apply:

- Rate of pull – 25.4 mm per minute.
- Reference – EIA 364-38A.

7.3 Side Load Capacity – The attached cable and board shall not exhibit any damage, nor opens detected (2 ohms maximum) with LLCR test when a load of not less than 75 N is applied at a rate of 25.4 mm/min to the attached cable in a plane parallel to the PCI bracket, in the direction of the smaller dimension of the receptacle. The receptacle connector shall be properly soldered to the printed circuit board and the receptacle lock plate properly installed between the receptacle and PCI bracket for samples without mounting ears. Samples with mounting ears should be attached to the PCI bracket with 2.5mm mounting screws. The PCI bracket is to be fastened at the ends in a manner as to simulate mounting to a PCI chassis.

7.4 Longitudinal Capacity – The attached cable and board shall not exhibit any damage, nor opens detected (2 ohms maximum) with LLCR test when a load of not less than 100 N is applied at a rate of 25.4 mm/min to the attached cable in a plane parallel to the PCI bracket, in the direction of the larger dimension of the receptacle. The receptacle connector shall be properly soldered to the printed circuit board and the receptacle lock plate properly installed between the receptacle and PCI bracket for samples without mounting ears. Samples with mounting ears should be attached to the PCI bracket with 2.5mm mounting screws. The PCI bracket is to be fastened at the ends in a manner as to simulate mounting to a PCI chassis.

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7.5 Vibration (Random) - EIA 364-28

- Test Condition – VII, Letter D.
- Vibration Amplitude - $0.02g^2/Hz$. Between 20-500Hz. Minimum.
- Duration – 15 minutes along each of three orthogonal axes.
- Mounting - Rigidly mount assemblies.
- No discontinuities greater than 1 microsecond.

7.6 Solderability - BUS-19-002/A

- Steam aging – 1 hour.
- Contact areas evaluated shall meet 95% minimum coverage.
- Test 10 contacts spread over 3 samples.

7.7 Reseating

Manually unplug / plug the mated connector assembly. Perform 3 cycles. There shall be no evidence of physical damage.

8.0 Environmental Conditions

Perform environmental testing per EIA-364-1000.01. Test groups 1,2,3,4 and 7 apply.

8.1 Thermal Shock - EIA 364-32

- Test Condition I, 10 cycles
- Temperature Range - Between -55 and +85 degrees C.

8.2 High Temperature Life - EIA 364-17


- Test Duration – 456 hours.
- Temperature - 90° C.
- Reference EIA 364-1000.01, Table 8.

8.3 High Temperature Life (preconditioning) - EIA 364-17

- Test Duration – 240 hours.
- Temperature - 90° C.
- Reference EIA 364-1000.01, Table 9.

8.4 Temperature/Humidity Cycling - (preconditioning) - EIA 364-31

- Cycle the connector between $25^{\circ}C \pm 3^{\circ}C$ at 80% RH \pm 3% RH and $65^{\circ}C \pm 3^{\circ}C$ at 50% RH \pm 3% RH. Ramp times should be 0.5 hour and dwell times should be 1.0 hour. Dwell times start when the temperature and humidity have stabilized within the specified levels. Perform 24 such cycles.

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8.5 **Durability** - The cycle life shall exceed 250 mating cycles, without physical damage or exceeding low level contact resistance when mated. No more than 1% of contacts shall exhibit exposed base metal.

- a. Cycling rate - 600 cycles per hour.
- b. Reference - EIA 364-09.

8.6 **Durability** (preconditioning) - 50 cycles

- a. Cycling rate - 600 cycles per hour.
- b. Reference - EIA 364-09.

8.7 **Industrial Mixed Flowing Gas** (IMFG) - EIA 364-65

- a. Class – IIA.
- b. Preconditioning – 50 mating cycles.
- c. Duration - 7 days.
- d. Reference - EIA 364-1000.01, test group 4, option #2.

8.8 **Thermal Disturbance** – EIA 364-1000.01

- a. Cycle the mated connectors between 15°C ±3°C and 85°C ±3°C, as measured on the part. Ramps should be a minimum of 2°C per minute and dwell times should insure that the contacts reach the temperature extremes (a minimum of 5 minutes). Humidity is not controlled. Perform 10 such cycles.

9.0 **Quality Assurance Provisions**

9.1 **Equipment Calibration**

All test equipment and inspection facilities used in the performance of any test shall be maintained in a calibration system in accordance with ANSI Z-540 and ISO 9000.


9.2 **Inspection Conditions**

Unless otherwise specified herein, all inspections shall be performed under the following ambient conditions:

- a. Temperature: 25 +/- 5 degrees C.
- b. Relative Humidity: 30% to 60%.
- c. Barometric Pressure: Local ambient.

9.3 **Acceptance**

- 9.3.1 Electrical and mechanical requirements placed on test samples as indicated in paragraphs 6.0 and 7.0 shall be established from test data using appropriate statistical techniques or

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shall otherwise be customer specified, and all samples tested in accordance with this product specification shall meet the stated requirements.

- 9.3.2 Failures attributed to equipment, test set-up, or operator error shall not disqualify the product. If product failure occurs, corrective action shall be taken and samples resubmitted for qualification.

9.4 Qualification Testing

Qualification testing shall be performed on sample units produced with equipment and procedures normally used in production. The test sequence shall be as shown in Table 2.

9.5 Requalification Testing

If any of the following conditions occur, the responsible product engineer shall initiate requalification testing consisting of all applicable parts of the qualification test matrix, Table 2.

- a. A significant design change is made to the existing product, which impacts the product form, fit or function. Examples of significant changes shall include, but not be limited to, changes in the plating material composition or thickness, contact force, contact surface geometry, insulator design, contact base material, or contact lubrication requirements.
- b. A significant change is made to the manufacturing process, which impacts the product form, fit or function.
- c. A significant event occurs during production or end use requiring corrective action to be taken relative to the product design or manufacturing process.


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TABLE 2 - QUALIFICATION TESTING MATRIX

		TEST GROUP	TEST GROUP	TEST GROUP	TEST GROUP	TEST GROUP	TEST GROUP	TEST GROUP	TEST GROUP	TEST GROUP
		1	2 ⁽¹⁾	3	4	5 ⁽²⁾	6	7	8	9
TEST	PARA .	TEST SEQUENCE								
Examination of Product	5.4	1	1	1	1	1	1	1	1,4	1,3
Contact Resistance, Low Level	6.1	2,5,7	2,5,7,9	2,5,7	2,4,6,8,10,12,14	3,5				
Insulation Resistance	6.2		10							
Dielectric Withstanding Voltage	6.3		11			2,6				
Current rating	6.4						2			
Differential Impedance (peak)	6.5							2		
Insertion Loss	6.6							3		
Near End Cross talk	6.7							4		
Within Pair Skew	6.8							5		
Mating / Unmating Force	7.1							6		
Retention Force	7.2						3			
Side Load Capacity	7.3								3	
Longitudinal Capacity	7.4								2	
Vibration	7.5			6						
Solderability	7.6									2
Reseating	7.7	6	8		13					
Thermal Shock	8.1		4							
High Temperature Life	8.2	4								
High Temp. Life (preconditioning)	8.3			4	5					
Temperature / Humidity Cycling	8.4		6							
Durability	8.5					4				
Durability (preconditioning)	8.6	3	3	3	3					
Industrial Mixed Flowing Gas	8.7				7, 9 ⁽⁴⁾					
Thermal Disturbance	8.8				11					
Sample Quantity / Group		Note 3	Note 3	Note 3	Note 3	Note 3	Note 3	Note 3	Note 3	Note 3

(1) Five of the ten samples are to be mounted on boards for LLCR. The remaining five samples for IR and DWV are not mounted to boards.

(2)Thirty positions over the five samples are to be checked for DWV. All remaining positions are to be checked for LLCR. LLCR is not read on positions where DWV is measured.


(3) Samples: Test groups 1 & 3 = 5 receptacles and 5 plug insert assemblies
Test group 2 = 10 receptacles and 10 plug insert assemblies
Test groups 4,5,6 & 8 = 5 receptacles and 5 plug pigtail assemblies
Test group 7 = 1 receptacle and 1 double-ended cable assembly, 1 meter long
Test group 9 = 3 receptacles and 3 plug insert assemblies

(4) LLCR measured after 5 days unmated and then after 2 days mated.

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REVISION RECORD

Rev	Page	Description	EC#	Date
A	ALL	RELEASE	V21224	7/25/02
B	2,3,5,6,7,10	Changed solderability spec., removed Differential Impedance (Nominal), removed Contact Retention, added plug sample description	V21599	10/3/02
C	3	Add Thumbscrew Material to Section 5.2.1	V21829	11/26/02
D	10	Test Group 4 - add LLCR measurement after durability and after 5 days unmated Note 4 to reflect actual test sequence	V03-0994	9/3/03
E	All	Change logo	V06-0547	06/07/06

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